6.5 Noise and Vibration

Sound is a fundamental component of daily life. When sounds are perceived as desired, beneficial, or otherwise pleasing, they are typically considered as having a positive effect on daily life. When sounds are perceived as unpleasant, unwanted, or disturbingly loud, they are considered *noise*. Noise may interfere with a broad range of human activities such as communication or sleep. Noise disturbance varies depending on the conditions and on the particular land uses and activities near the sound source and the sensitivity of those land uses.

Vibration is motion described in terms of displacement, velocity, or acceleration. People are usually sensitive to perceptible vibration. An increase in noise or vibration can affect the peacefulness, serenity, and sacredness of residential, commercial, recreational, and cultural locations.

This section describes noise and vibration in the study area. It then describes potential noise and vibration impacts from construction and operation of the proposed export terminal.

6.5.1 Regulatory Setting

Laws and regulations relevant to noise and vibration are summarized in Table 6.5-1.

Table 6.5-1. Regulations, Statutes, and Guidelines for Noise and Vibration

Regulation, Statute, Guideline	Description
Federal	
Noise Control Act of 1972 (42 USC § 4910)	Protects the health and welfare of U.S. citizens from the growing risk of noise pollution, primarily from transportation vehicles, machinery, and other commerce products. Increases coordination between federal researchers and noise-control activities; establishes noise emission standards; and presents noise emission and reduction information to the public.
Federal Transit Administration Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06, May 2006)	Provides procedures and guidance for analyzing the level of noise and vibration, assessing the resulting impacts, and determining possible mitigation for most federally funded transit projects.
Federal Railroad Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment (October 2012)	Provides guidance and methods for the assessment of potential noise and vibration impacts resulting from proposed high-speed ground transportation projects.
U.S. Environmental Protection Agency Railroad Noise Emission Standards (2014) (40 CFR 201)	Establishes final noise emission standards for surface carriers engaged in interstate commerce by railroad. This rulemaking is pursuant to Section 17 of the Noise Control Act of 1972.
FRA Railroad Noise Emission Compliance Regulations (49 CFR 210)	Indicates the minimum compliance regulations necessary to enforce EPA's Railroad Noise Emission Standards.

Regulation, Statute, Guideline	Description
FRA Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings (49 CFR 222 and 229)	Requires the sounding of locomotive horns at public highway rail grade crossings. Considers the allowance of Quiet Zones when the increased risk is mitigated with supplementary grade crossing safety measures.
State	
Maximum Environmental Noise Levels (WAC 173-60)	Establishes maximum environmental noise levels. However, noise from surface carriers engaged in interstate commerce by railroad are exempt from these regulations.
Local	
Cowlitz County Code (CCC 10.25) (Nuisance Noises)	Regulates excessive intermittent noise that interferes with the use, value and enjoyment of property and which pose a hazard to the public health, safety, and welfare.

Notes:
USC = United States Code; FTA = Federal Transit Administration; FRA = Federal Railroad Administration; CFR = Code of Federal Regulations; EPA = U.S. Environmental Protection Agency; WAC = Washington Administrative Code; CCC = Cowlitz County Code

6.5.2 Study Area

The study areas for noise and vibration are the same for both the On-Site Alternative and Off-Site Alternative, and were identified using the Corps' NEPA scope of analysis Memorandum For Record (February 14, 2014) and refined to reflect current conditions near the project areas.

The study area for direct impacts is within 1 mile of the project areas. The study area for indirect impacts is the direct impacts study area plus the area within 1 mile from the centerline on the Reynolds Lead and BNSF Spur between Longview Junction and the project area for both the On-Site Alternative and Off-Site Alternative. Figure 6.5-1 illustrates the combined study area.

6.5.3 Methods

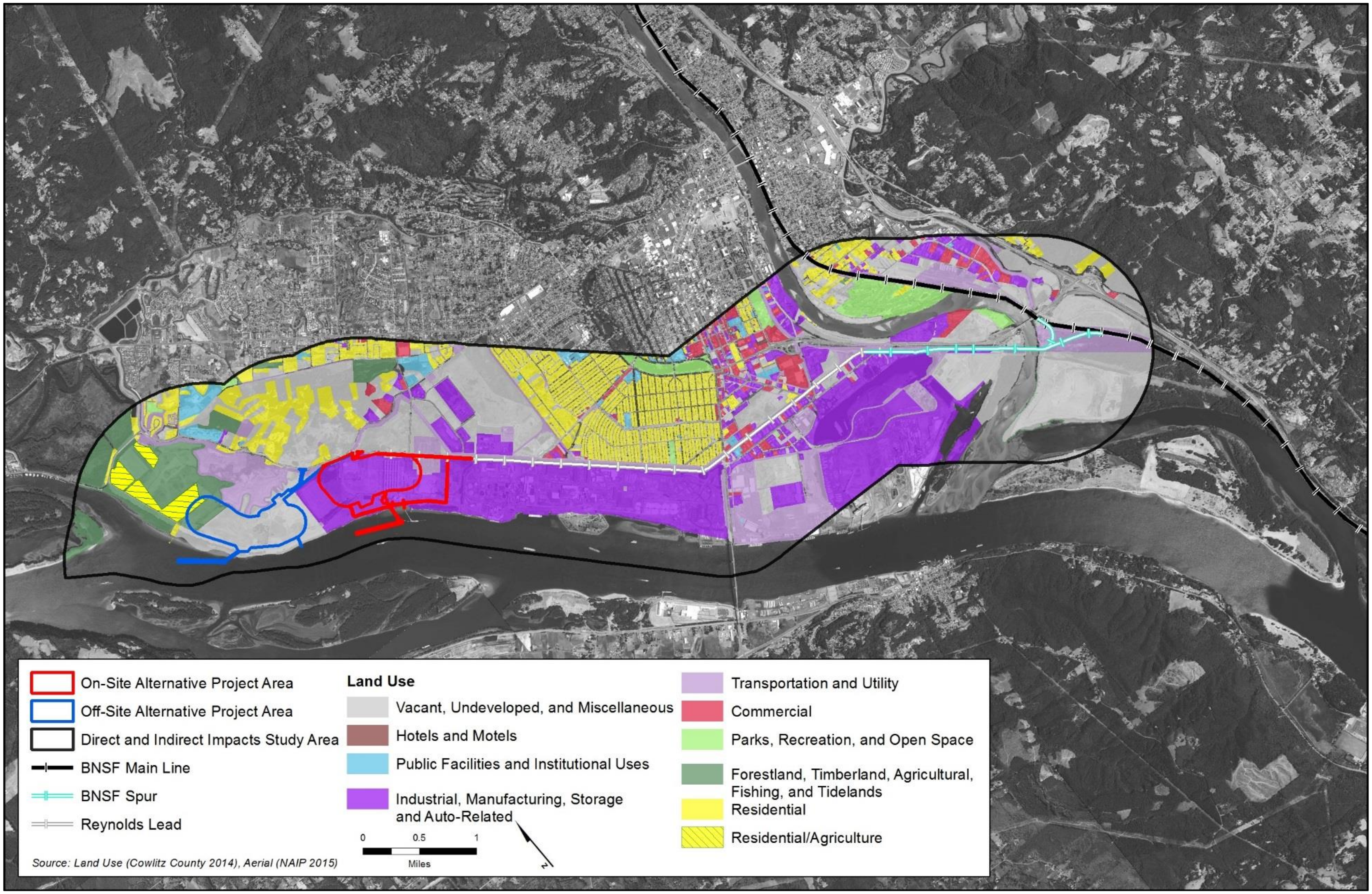
This section describes the sources of information and methods used to evaluate the potential noise and vibration impacts associated with the construction and operation of the proposed export terminal. Methods for field surveys conducted in the study area are also provided.

6.5.3.1 Information Sources

The following sources of information were used to evaluate noise and vibration impacts.

- Information provided by the Applicant, including project design features and a list of typical construction and operation equipment.
- Lists of typical construction and operation equipment from reference projects and typical corresponding noise and vibration levels.
- Existing and future-year rail traffic estimates for the Reynolds Lead and BNSF Spur provided by the Longview Switching Company (LVSW) and the Applicant.
- Data on locomotive and train noise levels.
- Ambient noise monitoring data collected during field surveys in the study area.

Figure 6.5-1. Noise and Vibration Study Area



6.5.3.2 Field Surveys

Field surveys were performed from October 28 through November 10, 2014, and from January 11 through 16, 2015, to measure existing outdoor sound levels (ambient noise levels) at representative noise-sensitive receptors in the study areas. Noise-sensitive receptors include residential and institutional land uses such as schools and churches (Figure 6.5-2). The surveys focused on locations in the study area where noise-sensitive receptors could be exposed to noise from project-related activities. Short-term (10-minute) and long-term (24-hour) sound-level meters were set up for measurements at selected noise-sensitive receptors (Figure 6.5-3).

Four sound-level meters were installed on October 27, 2014, then relocated to another location on November 2, 2014, providing at least 6 full days of data collected at each of the eight long-term ambient noise survey locations shown in Figure 6.5-3. The meters were mounted on utility poles with the microphone approximately 10 feet above the ground surface. Short-term measurements were conducted during the same time period as the long-term survey. The microphone of the short-term equipment was placed 5 feet above ground surface and the noise level was measured and recorded for a period of 10 minutes at each short-term survey location. Figure 6.5-3 illustrates the short-term ambient noise survey locations.

The *NEPA Noise and Vibration Technical Report* (ICF International and Wilson Ihrig 2016) provides additional information on the methods used to obtain existing ambient noise levels.

6.5.3.3 Methods for Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on noise and vibration.

Construction

The Applicant has identified three construction scenarios.

- **Truck.** If material is delivered by truck, it is assumed approximately 88,000 truck trips would be required over the construction period. Approximately 56,000 loaded trucks would be needed during the peak construction year.
- **Rail.** If material is delivered by rail, it is assumed approximately 35,000 loaded rail cars would be required over the construction period. Approximately two-thirds of the rail trips would occur during the peak construction year.
- **Barge.** If material is delivered by barge, it is assumed approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year. Because the project areas for the On-Site Alternative and Off-Site Alternative do not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River.

The methods for analyzing noise and vibration impacts related to construction are described in this subsection. The *NEPA Noise and Vibration Technical Report* provides additional information on the methods to analyze potential impacts.

Figure 6.5-2. Noise-Sensitive Land Uses in the Study Area

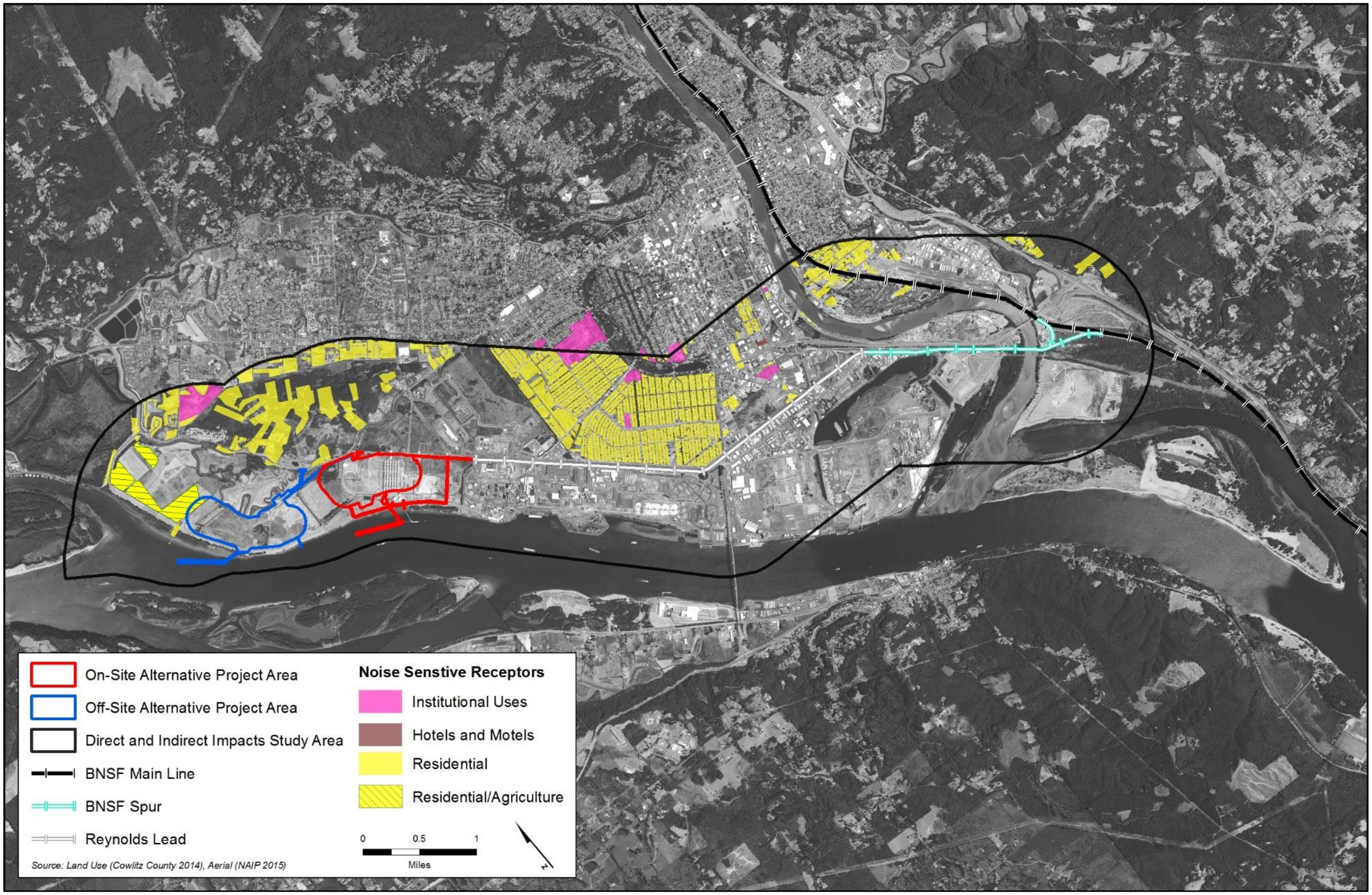
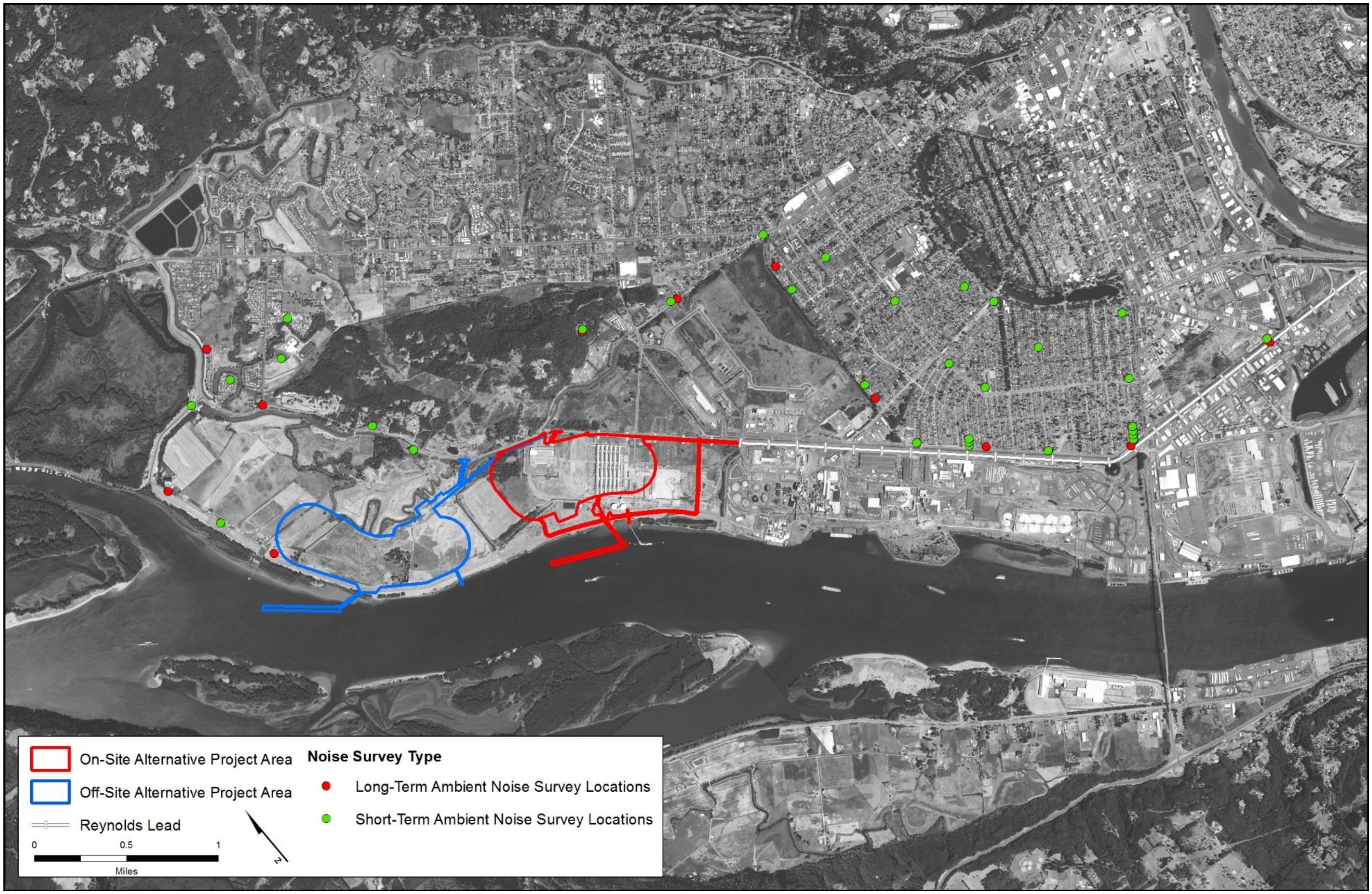


Figure 6.5-3. Ambient Sound Pressure Level Survey Locations



Noise

Construction of the proposed export terminal at either the On-Site Alternative or Off-Site Alternative locations would occur primarily during daytime hours. Daytime construction of the terminal at these locations would be exempt from Washington State permissible noise level regulations (Washington Administrative Code [WAC] 173-60-040). To provide context regarding construction noise levels, construction noise in the project areas was evaluated per guidelines established by the Federal Transit Administration (FTA) (2006) and Federal Railroad Administration (FRA) (2012). Construction noise, including pile-driving, which is typically the most dominant source of noise complaints during construction, was estimated at the noise-sensitive receptors in the study area using detailed information about the anticipated roster of construction equipment to be used and based on information provided by the Applicant. For purposes of this analysis, and because the exact locations of construction equipment and processes are either unknown at this time or could vary during the course of construction, noise was treated as originating from the acoustic center of the geographic locations. An assessment of potential indirect noise impacts from project-related construction trains and vehicle traffic was also performed.

Vibration

Pile-driving would be the dominant source of ground vibration during construction. Vibration during pile-driving was calculated using the methods from *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2006). Human annoyance can occur at much lower vibration levels than vibration levels causing cosmetic damage to structures. Therefore, this lower “annoyance” threshold was used to assess vibration impacts.

Operations

The methods for analyzing noise and vibration impacts related to operations are described in this subsection.

Direct Impacts

The following describes the methods to evaluate potential noise and vibration impacts in the project areas.

Noise

The Computer-Aided Noise Abatement Noise Prediction Model (Cadna/A®, Version 4.4.145) was used to estimate the propagation of sound from operation of the terminal in the project areas. The model predicted noise levels at noise-sensitive receptors in the study areas and generated noise contours (lines of equal noise levels) for comparison to the Washington State regulatory noise criteria.[1] The *NEPA Noise and Vibration Technical Report* provides the list of sound sources included in the model and the parameters and assumptions for each noise source, equipment sound levels, and other assumptions. The equipment analyzed included transfer towers, conveyor belts, conveyor drives, a tandem rotary dumper, shiploaders, stacker/reclaimers, surge bins and the rail loop. The model parameters and assumptions considered buildings and structures, coal storage piles, surface

[1] Cadna/A® considers natural and human-made topographical barrier effects, including terrain features and structures such as major buildings, storage tanks, and large equipment.

acoustical absorption, foliage, temperatures and relative humidity and cladding for exterior surfaces.

Vibration

There would be no substantial sources of ground vibration in the project area for the On-Site Alternative and Off-Site Alternative during operations, except trains moving on the rail loop in the project area. Using data and methods provided in *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2006), it was determined vibration from train operations is unlikely at distances greater than 40 feet from a railroad track for infrequent events (less than 30 trains per day). The closest vibration-sensitive receptor (a residence) is approximately 275 feet from the outer track of the rail loop. Therefore, an estimate of vibration generated during operation of the terminal operations was not necessary.

Indirect Impacts

The following describes the methods to evaluate potential noise and vibration impacts from project-related rail and vessel traffic.

Rail Traffic Noise

As described in Section 6.1, *Rail Transportation*, LVSW plans to upgrade the Reynolds Lead and part of the BNSF Spur as a separate action should it be warranted by increased rail traffic resulting from existing and future customers. This analysis assessed rail noise with planned track improvements and without track improvements.

A noise model was used to predict noise levels generated by rail traffic along the Reynolds Lead and BNSF Spur for existing conditions, the No-Action Alternative in 2018, the No-Action Alternative in 2028, and the On-Site Alternative and Off-Site Alternative in 2028. Section 6.1, *Rail Transportation*, describes rail traffic volumes on the Reynolds Lead and BNSF Spur assumed for these scenarios. The model assumed continuously welded rail, consistent with the existing rail on the Reynolds Lead and BNSF Spur.

The analysis considered two types of rail noise.

- *Wayside noise*, which refers to the combined effect of locomotive noise and car/wheel noise.
- *Horn noise*, which refers to the sound of locomotive warning horns sounded at public at-grade road/rail crossings. In addition, LVSW operating rules require train engineers to sound locomotive horns at private at-grade crossings on the Reynolds Lead. Because horn sounding is intentionally loud to warn motorists of oncoming trains, the horn noise footprint is often larger than the wayside noise footprint.

There are five public at-grade crossings and three active private crossings along the Reynolds Lead and BNSF Spur.

- Dike Road
- 3rd Avenue
- California Way
- Oregon Way
- Industrial Way

- Weyerhaeuser entrance west of Douglas Street (private crossing)
- Weyerhaeuser entrance at Washington Way (private crossing)
- 38th Avenue entrance to the Applicant's existing bulk product terminal (private crossing)

The noise model included the FRA provision for train horn sounding not less than 15 seconds or more than 20 seconds before the locomotive reaches an at-grade crossing. To be conservative, the analysis assumed locomotive horn sounding would begin 20 seconds before the locomotive reaches an at-grade crossing. The noise levels were predicted for trains running both with and without sounding horns at crossings.

Noise from surface carriers engaged in interstate commerce by railroad is exempt from Washington State maximum permissible noise level regulations (WAC 173-60-040). Therefore, there are no criteria or guidelines for assessing noise impacts specifically from freight trains, and high-speed rail and transit project impact guidelines were determined to represent the most appropriate measure.

FRA-adopted noise assessment methods developed by FTA were used to calculate potential noise impacts from operations of the terminal at the On-Site Alternative and Off-Site Alternative locations. These methods are documented in the *Transit Noise and Vibration Impact Assessment* (FTA/FRA guidance) (Federal Transit Administration 2006). FRA generally relies on this guidance for analysis of potential noise impacts from conventional rail vehicles traveling at speeds below 90 miles per hour (Federal Railroad Administration 2012).

To supplement FTA/FRA guidance, freight rail source levels from the FRA *High Speed Ground Transportation Noise and Vibration Assessment* were used to characterize noise from freight rail vehicles (Federal Railroad Administration 2012). These guidelines determine noise impacts based on increases in ambient noise level (day-night sound level [L_{dn}][2] or peak hour equivalent sound level [L_{eq}],[3] depending on the type of receptor) after a project is completed. The acceptable increase depends on the existing ambient noise level.

FTA/FRA guidance noise impact criteria are based on the land use category receiving the noise. The FTA/FRA guidance identifies three land use categories for assessing potential noise impacts.[4]

- **Category 1.** Tracts of land where quiet is an essential element of their intended purpose, such as outdoor amphitheaters, concert pavilions, and national historic landmarks with significant outdoor use.
- **Category 2.** Residences and buildings where people normally sleep, including homes, hospitals, and hotels.
- **Category 3.** Institutional land uses (schools, places of worship, libraries) typically available during daytime and evening hours. Other uses in this category can include medical offices, conference rooms, recording studios, concert halls, cemeteries, monuments, museums, historical sites, parks, and recreational facilities.

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[2] The day-night sound level (Ldn) is essentially a 24-hour average noise level (in A-weighted decibels [dBA]) with a 10-decibel upward adjustment of noise levels occurring at night. This adjustment is made to account for most peoples' increased sensitivity to noise at night.

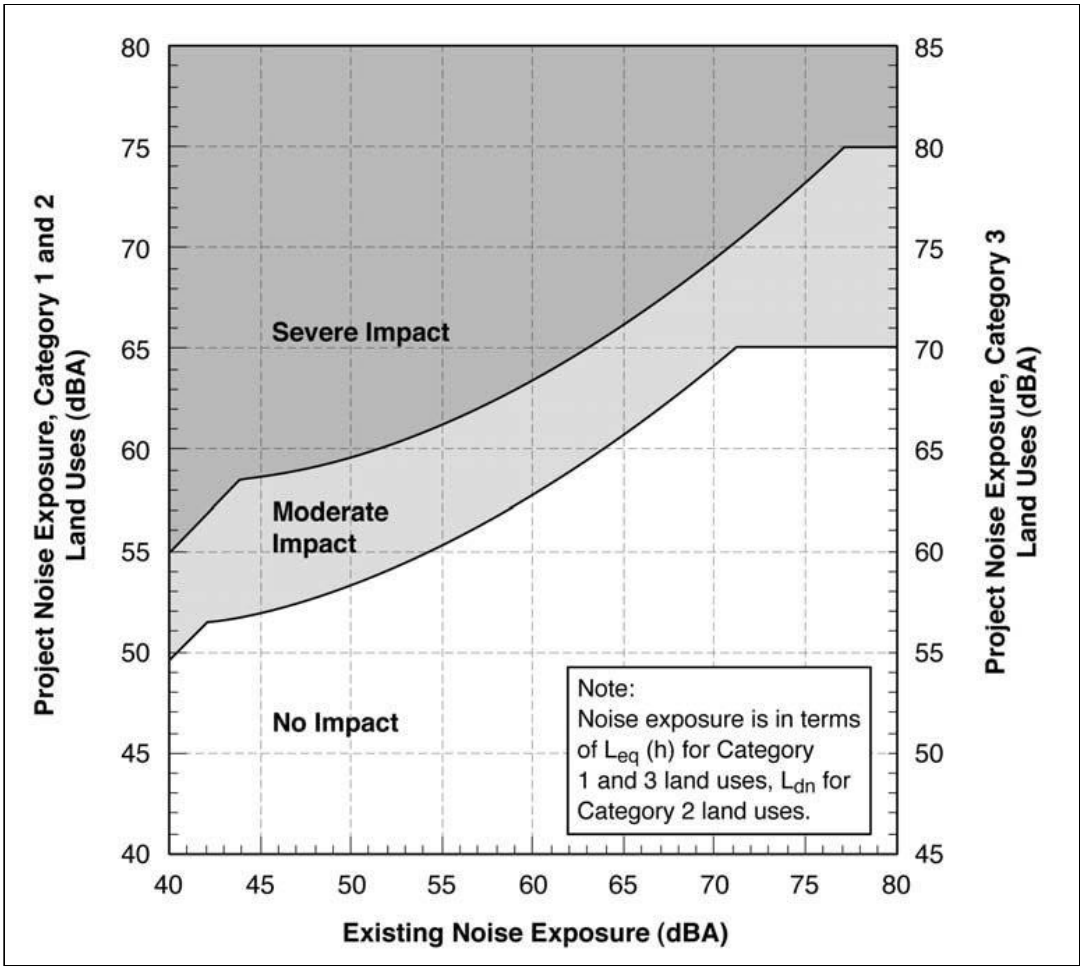
[3] The $L_{eq(h)}$ a noise metric representing a constant sound level containing the same sound energy as the actual fluctuating sound over an hour. As such, the L_{eq} can be considered an energy-average sound level.

[4] Noise exposure values are reported as hourly equivalent sound level ($L_{eq[h]}$]) for Category 1 and 3 land uses, and L_{dn} for residential land uses (Category 2).

The FTA/FRA guidance defines three noise impact category levels (Figure 6.5-4).

- **No impact.** The change in the noise level would result in an insignificant increase in the number of instances where people are highly annoyed by new noise.
- **Moderate impact**. The change in the noise level would be noticeable to most people but may not be enough to cause strong adverse community reactions.
- **Severe impact.** A significant percentage of people would be highly annoyed by the noise.

Figure 6.5-4. Noise Impact Criteria



Source: Federal Transit Administration 2006.

The level of impact is determined by the existing level of noise exposure and the change in noise exposure using a sliding scale according to the land uses affected. As the existing level of noise exposure increases, the additional noise exposure needed to cause a moderate or severe impact decreases. The contribution of project-related trains relative to the existing noise levels would differ according to the level of existing noise exposure (Figure 6.5-4). This sliding scale recognizes people who are already exposed to high levels of noise in the ambient environment are expected to tolerate smaller increases in noise in their community relative to locations with lower existing ambient levels. The increases between the On-Site Alternative and Off-Site Alternative in 2028 and the No Action 2028 levels were compared to the FTA/FRA guidance to determine the level of noise impact.

Rail Traffic Vibration

Using generalized ground surface vibration curves (Federal Transit Administration 2006) and correcting for speed, vibration from project-related train operations would be unlikely at distances greater than 40 feet from a railroad track for infrequent events (less than 30 passbys per day). The closest vibration-sensitive receptor (a residence) is approximately 150 feet away from the Reynolds Lead, and there are no vibration-sensitive receptors adjacent to the BNSF Spur. Therefore, no analysis was conducted to estimate vibration from rail operations.

Vessel Traffic Noise

The general assumptions used to assess impacts from stationary and moving vessels on the Columbia River are presented in Table 6.5-2.

Table 6.5-2. Assumptions Related to Noise from Stationary and Moving Vessels

Equipment	Noise level
Stationary vessels (moored ship)	65 dBA at a distance of 62 feet
Vessels under way	45 dBA at a distance of 400 feet
Foghorns	60 dBA at a distance of 1,800 feet

Notes:
See the *NEPA Noise and Vibration Technical Report* for detailed information on the sources of these noise level assumptions.
dBA = A-weighted decibel

Vessel Traffic Vibration

No analysis was conducted to estimate vibration generated during vessel operations. Project-related vessels would be similar to those already traveling on the Columbia River. There have been no documented cases of perceptible vibration onshore generated by ship traffic on the river.

6.5.4 Affected Environment

This section describes the affected environment related to noise and vibration potentially affected by the construction and operation of the proposed export terminal.

Figure 6.5-1 illustrates the land uses in the study area. Figure 6.5-2 illustrates the noise-sensitive receptors in the study area, including residential land uses. The closest noise-sensitive receptors to the project areas, Reynolds Lead, and BNSF Spur are residential land uses. These land uses are generally located north of the Reynolds Lead and Industrial Way (State Route [SR] 432) between Oregon Way and Washington Way (a distance of approximately 1.5 miles along the Reynolds Lead), with some residential land uses near the California Way and 3rd Avenue crossings of the Reynolds Lead.

As described in Section 6.5.3, *Methods,* long- and short-term surveys were conducted to determine existing conditions in the study area. Primary noise sources during the surveys varied by location, but were generally observed to include train traffic; vehicle road traffic; noise from existing industrial facilities, mills, and plants; residential activities; and noise from port activities. Table 6.5-3 provides a summary of the primary noise sources at the long-term ambient noise survey locations illustrated in Figure 6.5-3.

Table 6.5-3. Primary Noise Sources at Long-Term Ambient Noise Survey Locations

Long-Term Ambient Noise Survey Location	Noise Sources
602 California Way	California Way and Industrial Way vehicle traffic Trains on the Reynolds Lead Horizon Metals recycling center on California Way
111 15th Avenue	Industrial Way vehicle traffic Trains on the Reynolds Lead
221 Beech Street	Local vehicle traffic Industrial Way vehicle traffic Weyerhaeuser mill Trains on the Reynolds Lead
875 34th Avenue	Local vehicle traffic and residential activity PNW Metal Recycling at Mint Farm Industrial Park
3600 Memorial Park	Local vehicle traffic PNW Metal Recycling at Mint Farm Industrial Park
420 Rutherglen Drive	Distant industrial operations at Mint Farm Industrial Park Weyerhaeuser mill Port of Longview
4723 Mt. Solo Road	Vehicle traffic on Mt. Solo Road
1719 Dorothy Avenue	Local vehicle traffic and residential activity PNW Metal Recycling at Mint Farm Industrial Park
275 Barlow Point Drive	Birds, infrequent vehicle traffic, vessel noise including foghorns
149 Barlow Point Drive	Birds, vehicle traffic, vessel noise
Mount Solo Road	Vehicle traffic
1945 Schneiter Drive	Vehicle traffic

Notes:
See the *NEPA Noise and Vibration Technical Report* for additional information on the noise field surveys.

Figure 6.5-5 illustrates existing noise level contours for all noise sources. The existing ambient noise levels formed the baseline against which the impacts of the proposed export terminal were measured.

Figure 6.5-5a. Existing Rail Noise Contours, BNSF Spur to Reynolds Lead, Including Train Horns

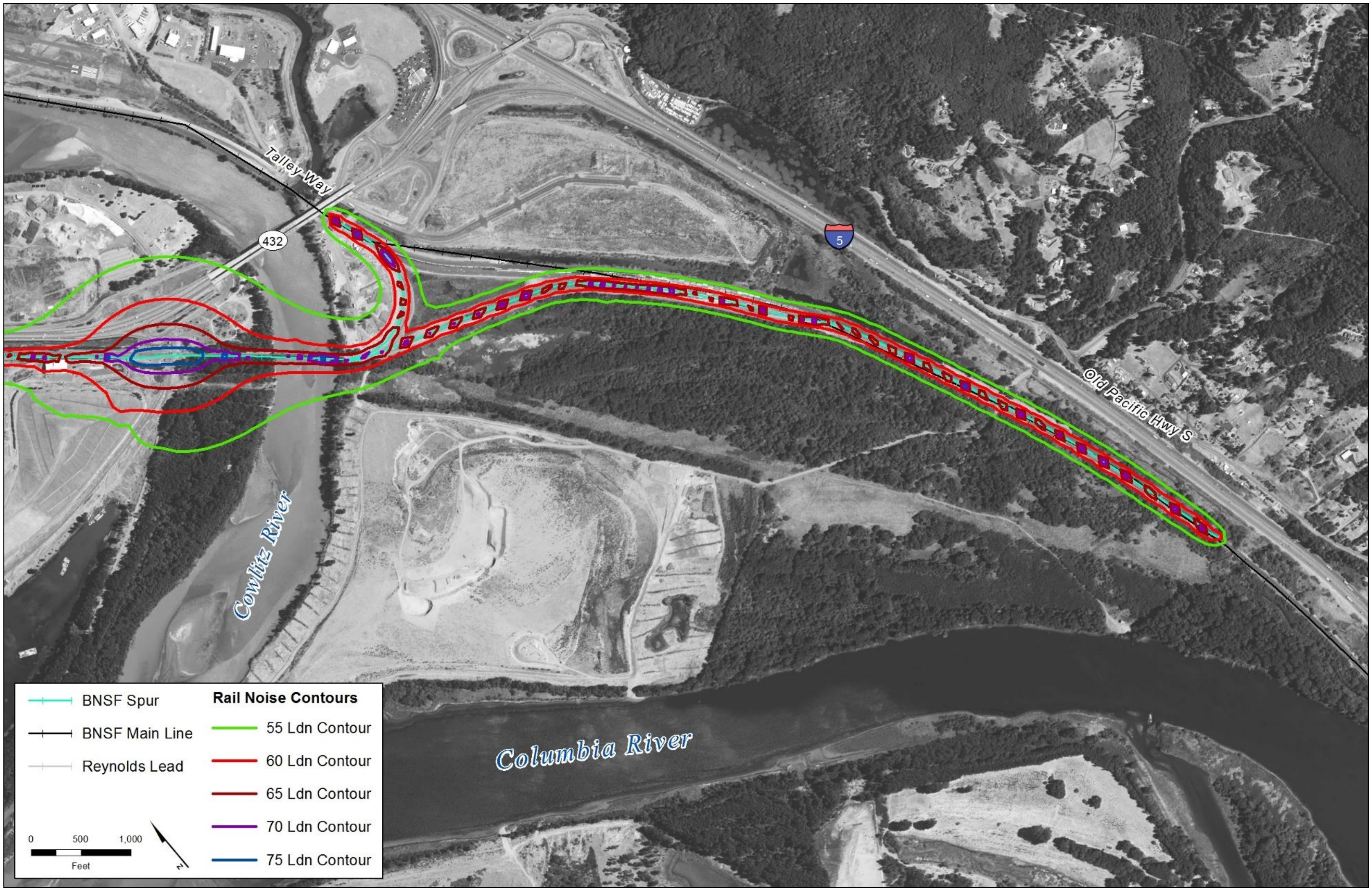


Figure 6.5-5b. Existing Rail Noise Contours, Beginning of Reynolds Lead, Including Train Horns

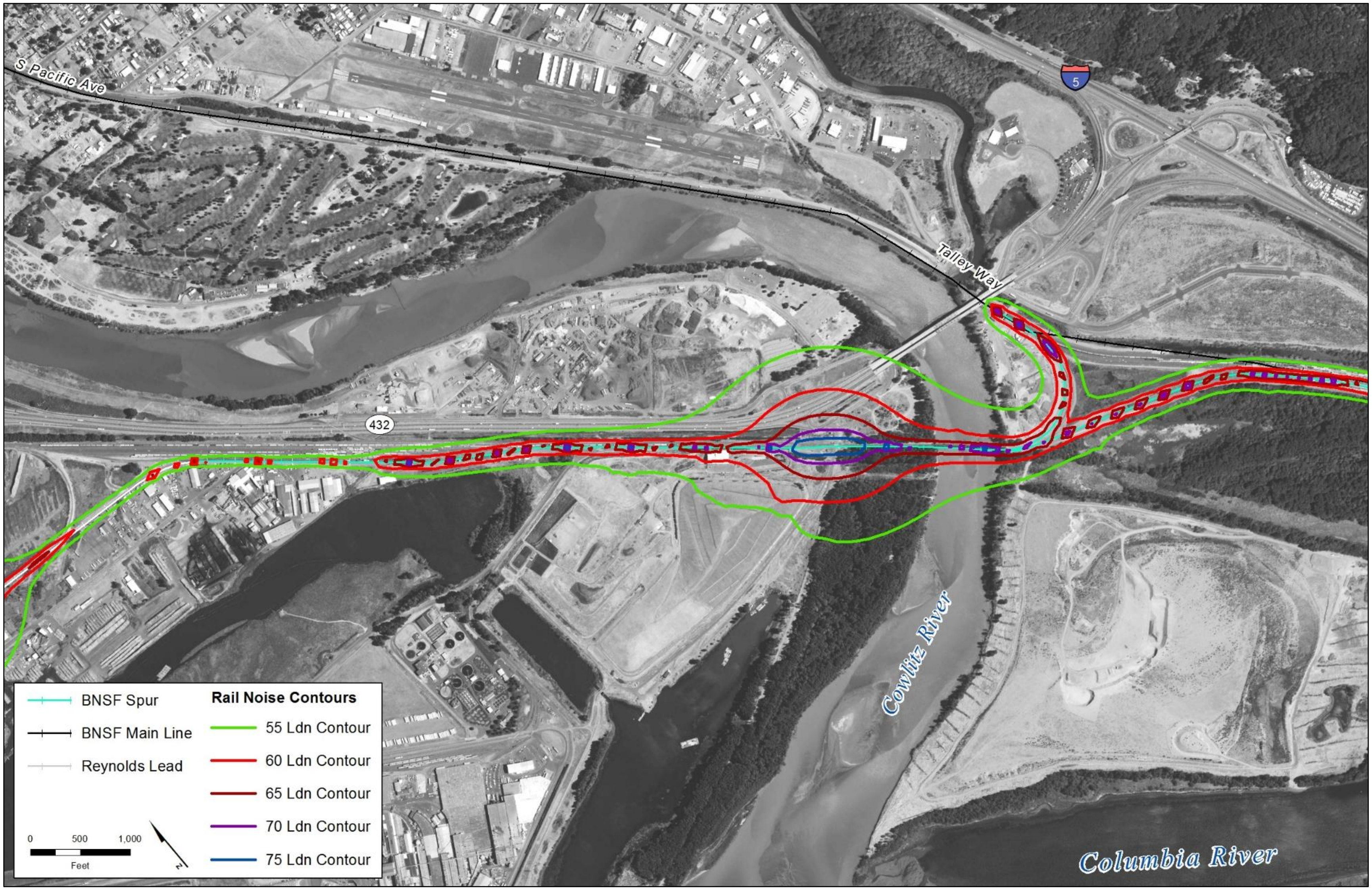
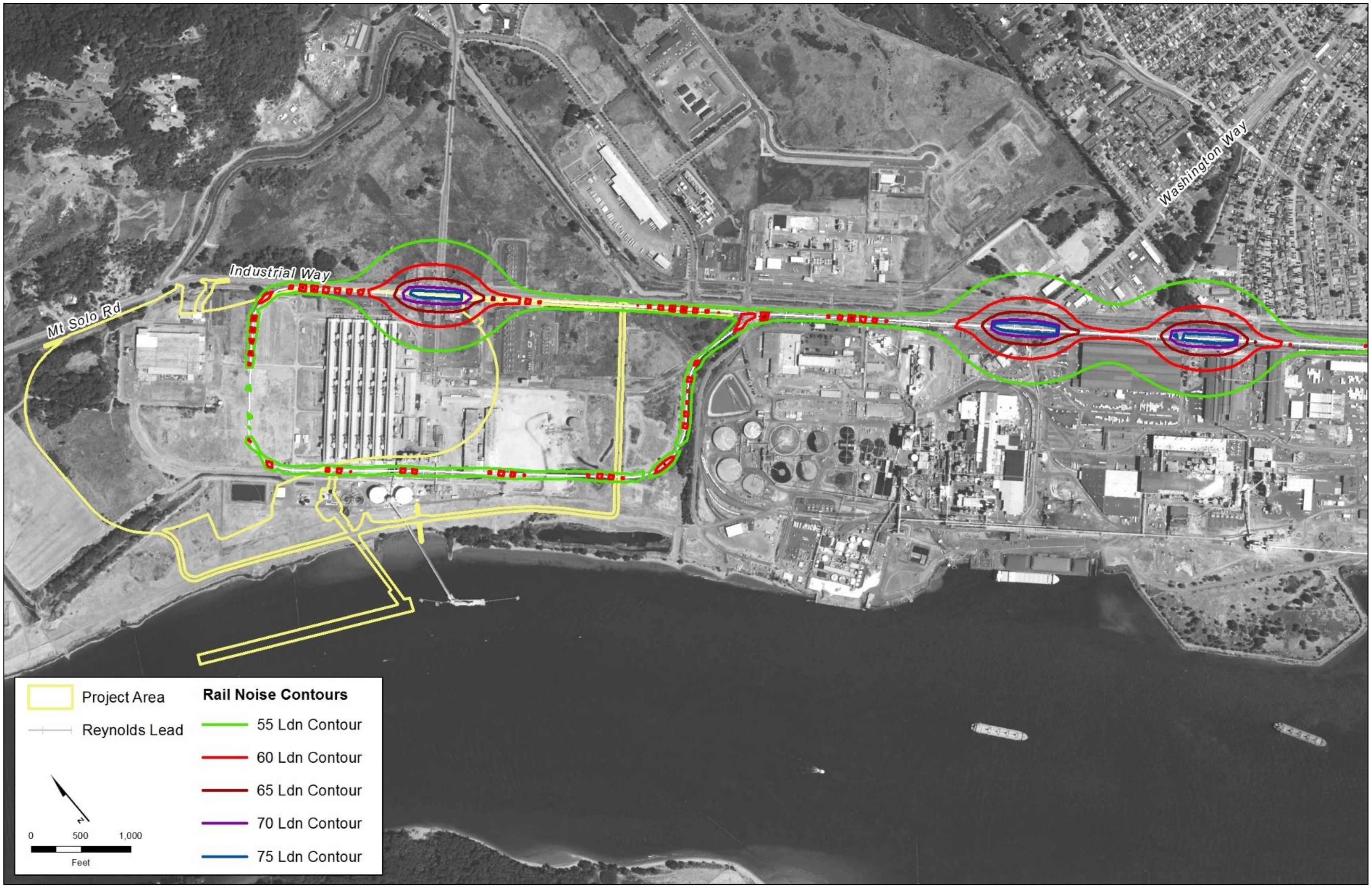


Figure 6.5-5c. Existing Rail Noise Contours, Mid-Reynolds Lead, Including Train Horns

Figure 6.5-5d. Existing Rail Noise Contours, End of Reynolds Lead, Including Train Horns



6.5.5 Impacts

This section describes the potential direct and indirect impacts related to noise and vibration from construction and operation of the proposed export terminal.

6.5.5.1 On-Site Alternative

Construction—Direct Impacts

Construction-related activities associated with the proposed export terminal at the On-Site Alternative location could result in direct impacts as described below.

Noise

The maximum noise level at the closest noise-sensitive receptor (the residence at 104 Bradford Place) would be 83 A-weighted decibels (dBA), which would occur during pile-driving. While not a regulatory noise standard for construction noise, to provide context, this noise level would exceed FTA/FRA noise-level criteria of 80 dBA for construction noise. Noise levels would not exceed 80 dBA at any other times during construction when there is no pile-driving, or when pile-driving is taking place approximately 1,500 feet from this residence.

Vibration

The maximum predicted vibration levels at the closest vibration-sensitive receptor (the residence at 104 Bradford Place) would be 72 velocity decibels during pile-driving. While not a regulatory standard for vibration during construction, to provide context, this vibration level would not exceed FTA/FRA criteria for vibration from construction at residences. Vibration from pile-driving would be not be substantial enough to have an adverse impact at the nearest residence.

Construction—Indirect Impacts

Construction of the terminal at the On-Site Alternative location would result in the following indirect impacts.

Vehicle Traffic Noise

Vehicles traveling to and from the project area, mainly on Industrial Way, represent a potential source of noise impacts during construction. A maximum of approximately 330 truck trips per day for the truck and barge construction material delivery scenarios would be required during the peak year of construction. The increase in truck traffic represents an increase of 3.3% in average daily traffic for all vehicles on Industrial Way. This increase in vehicular traffic would not result in a substantial change to the existing noise levels and would be temporary (during the peak year of construction). Therefore, terminal-related construction traffic would not result in an adverse noise impact.

Rail Traffic Noise

As described in Section 6.1, *Rail Transportation*, the terminal would add an average of 1.3 train trips during the peak construction year if construction materials are delivered by rail. Chapter 3, *Alternatives*, describes the construction scenarios. This level of rail activity would not cause noise levels to increase more than 3 L_{dn} (dBA). Terminal-related rail traffic would not result in noise level increases exceeding applicable criteria for a moderate or severe noise impact as illustrated in Figure 6.5-4.

Operations—Direct Impacts

Operation of the terminal at the On-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Noise

Figure 6.5-6 shows the predicted noise contours for operation of the terminal at the On-Site Alternative location. Noise from export terminal operations is projected to exceed the Washington State noise standard at one residence (104 Bradford Place). The residence where the exceedance would occur is within the 50-dBA contour, which is the applicable Washington State limit for nighttime noise levels in a residential area when the noise is from an industrial source. The predicted noise level at the residence is 55 dBA, which is comparable to the current nighttime noise level at this location. Other residences are located outside the noise level limit contours or would be shielded by topography.

Vibration

As described in Section 6.5.3, *Methods*, no vibration impacts associated with operation of the terminal at the On-Site Alternative location are anticipated. No substantial sources of ground vibration would occur at the project area during operations, and the closest vibration-sensitive receptor (a residence) is too far away to be affected by vibration from trains on the rail loop in the project area.

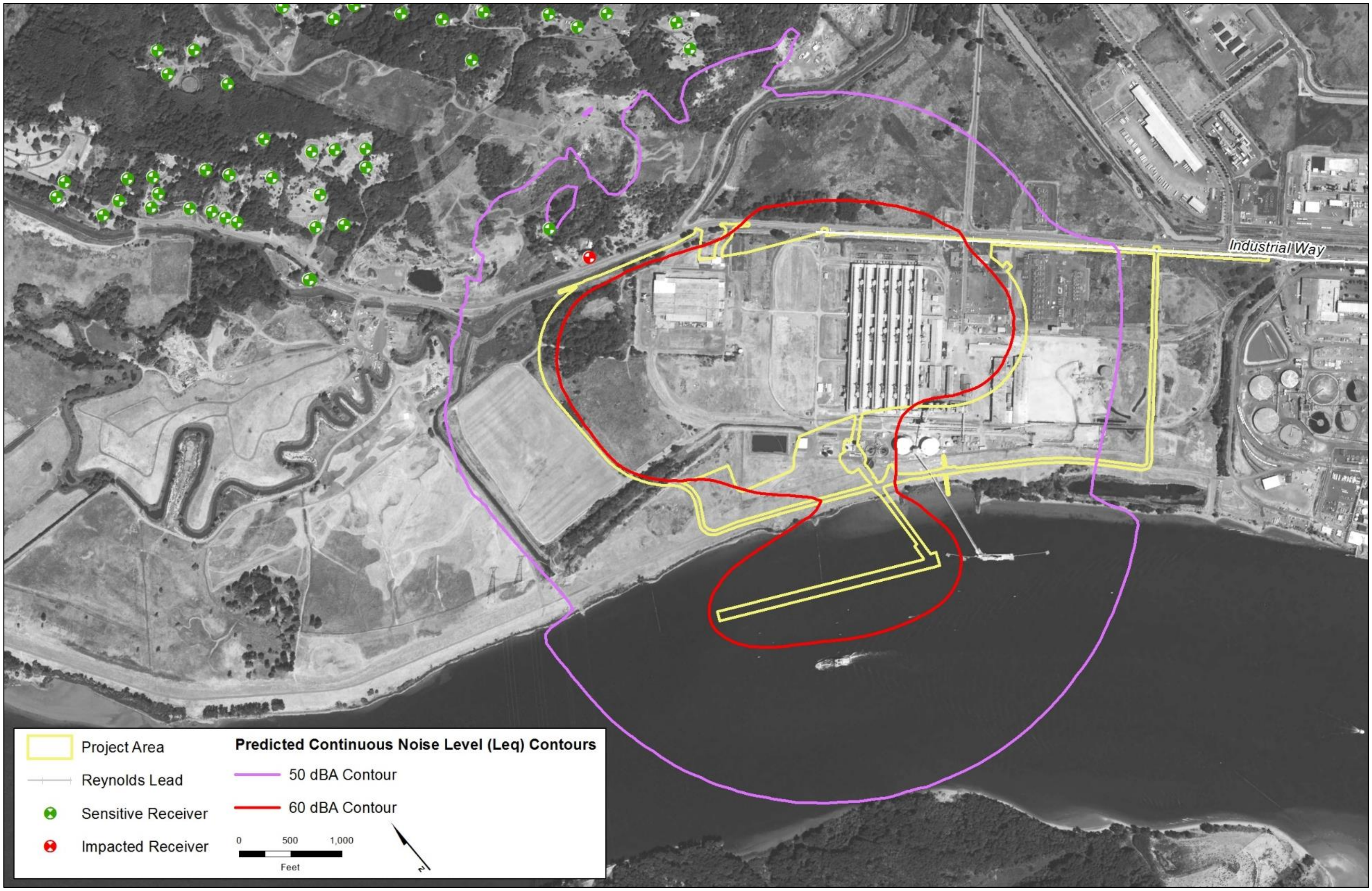
Operations—Indirect Impacts

Operation of the terminal at the On-Site Alternative location would result in the following indirect impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Vehicle Traffic Noise

Vehicles traveling to and from the project area, mainly on Industrial Way, represent a potential source of noise impacts during operations. As illustrated in Section 6.3, *Vehicle Transportation*, the annual average daily traffic on Industrial Way would increase approximately 5.7% under the On-Site Alternative. In general, a doubling of average daily traffic would be required to increase the L_{dn} from vehicular traffic by 3 dBA at the noise-sensitive receptors. In general, changes in a noise level of less than 3 dBA—as would be expected from the increase in traffic under the On-Site Alternative—would not be noticed by the human ear. Therefore, no noise-related indirect impacts from operations would be expected.

Figure 6.5-6. Predicted Continuous Noise Level (L_{eq}) Contours during Operations of the On-Site Alternative



Rail Traffic Noise

At full operations, the terminal would add 16 trains daily on the Reynolds Lead and BNSF Spur (8 loaded and 8 empty trains). Operation of the terminal would increase rail traffic-related noise along the Reynolds Lead and BNSF Spur primarily as a result of sounding train horns for public safety.

Figure 6.5-7 illustrates plots of the estimated equal noise levels (L_{dn}) with project-related rail traffic in 2028. The noise level contours include the noise from train horns sounded for public safety. Train engineers are required by FRA rules to sound locomotive horns at least 15 seconds, and not more than 20 seconds, in advance of public at-grade crossings. In addition, LVSW operating rules require train engineers to sound locomotive horns at private at-grade crossings. These sounding of horns would occur with or without track improvements on the Reynolds Lead and BNSF Spur that would allow higher train speed through the grade crossings.

Potential noise impacts were based on levels of potential impact (moderate impact or severe impact) defined in FTA/FRA guidance, which compares the existing level of noise exposure to the change in noise exposure with project-related trains. Table 6.5-4 summarizes the predicted number of affected noise-sensitive receptors exposed to moderate and severe impacts.[5] Figure 6.5-8 illustrates the residential land uses that would be exposed to moderate or severe noise impacts.

[5] The number of single residential units that could be affected at each multifamily residence was estimated using online satellite and street photography.

Figure 6.5-7a. Noise Contours with On-Site Alternative 2028 Rail Traffic, BNSF Spur to Reynolds Lead, Including Train Horns

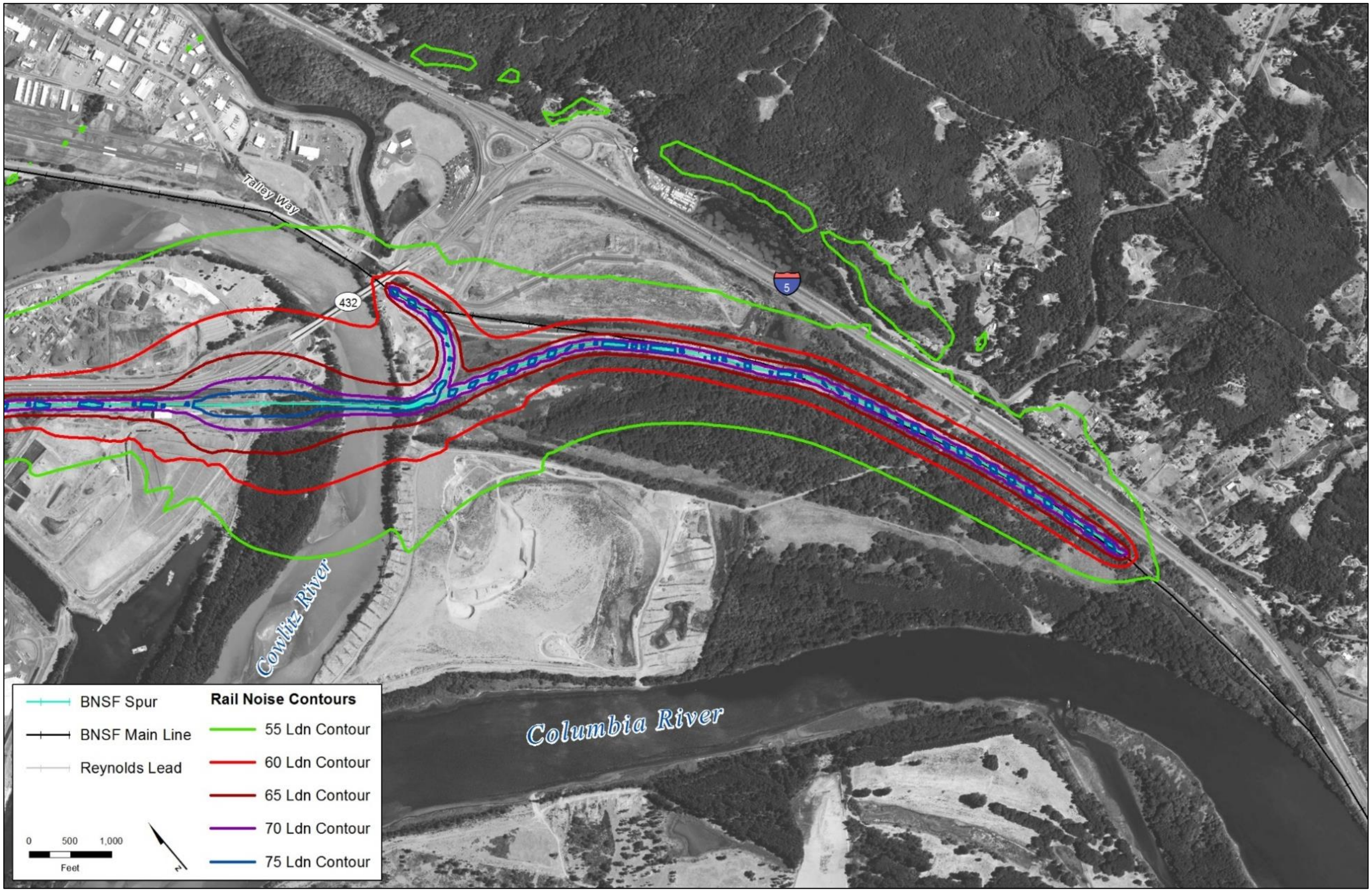


Figure 6.5-7b. Noise Contours with On-Site Alternative 2028 Rail Traffic, Beginning of Reynolds Lead, Including Train Horns

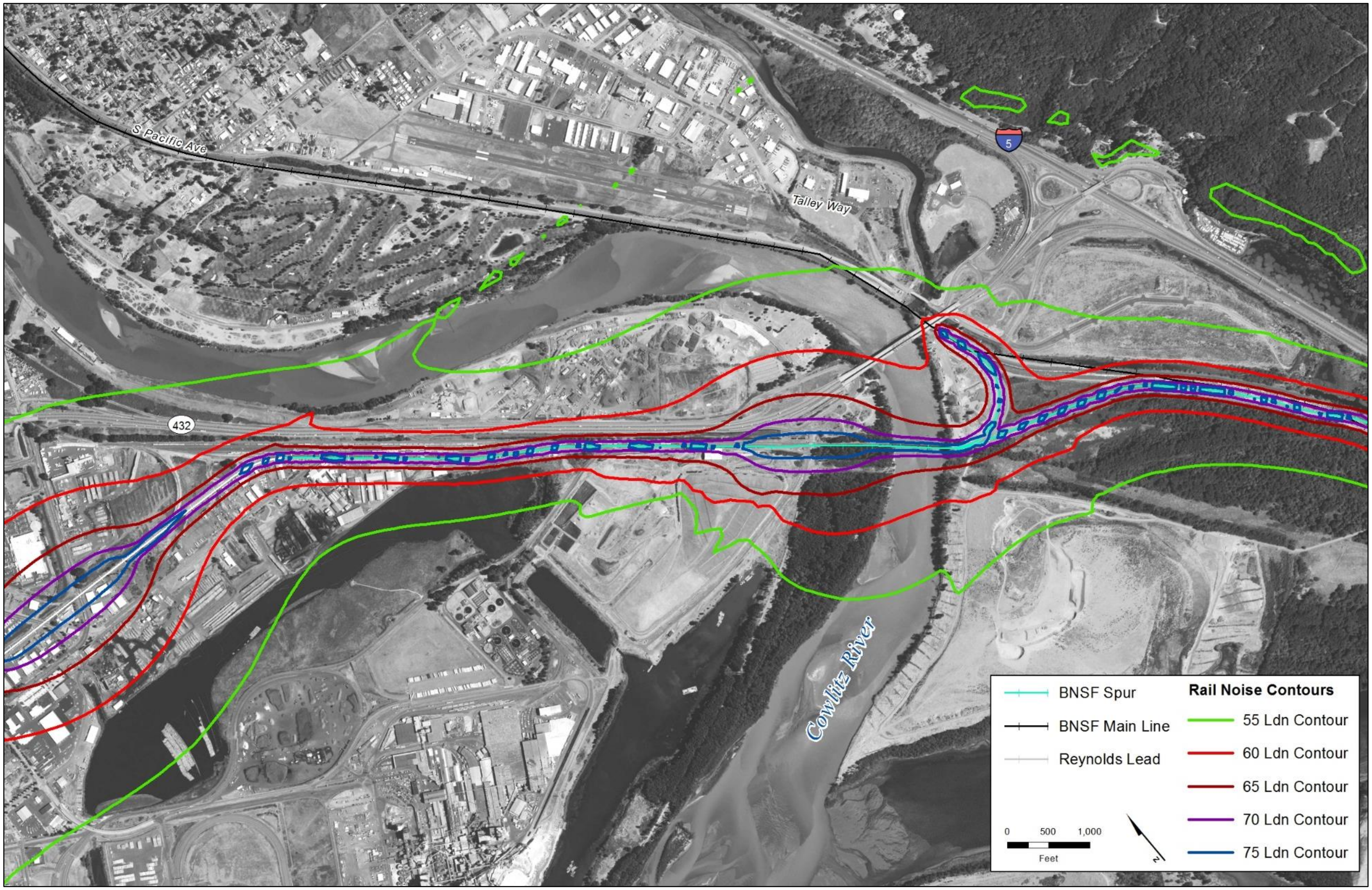


Figure 6.5-7c. Noise Contours with On-Site Alternative 2028 Rail Traffic, Mid-Reynolds Lead, Including Train Horns

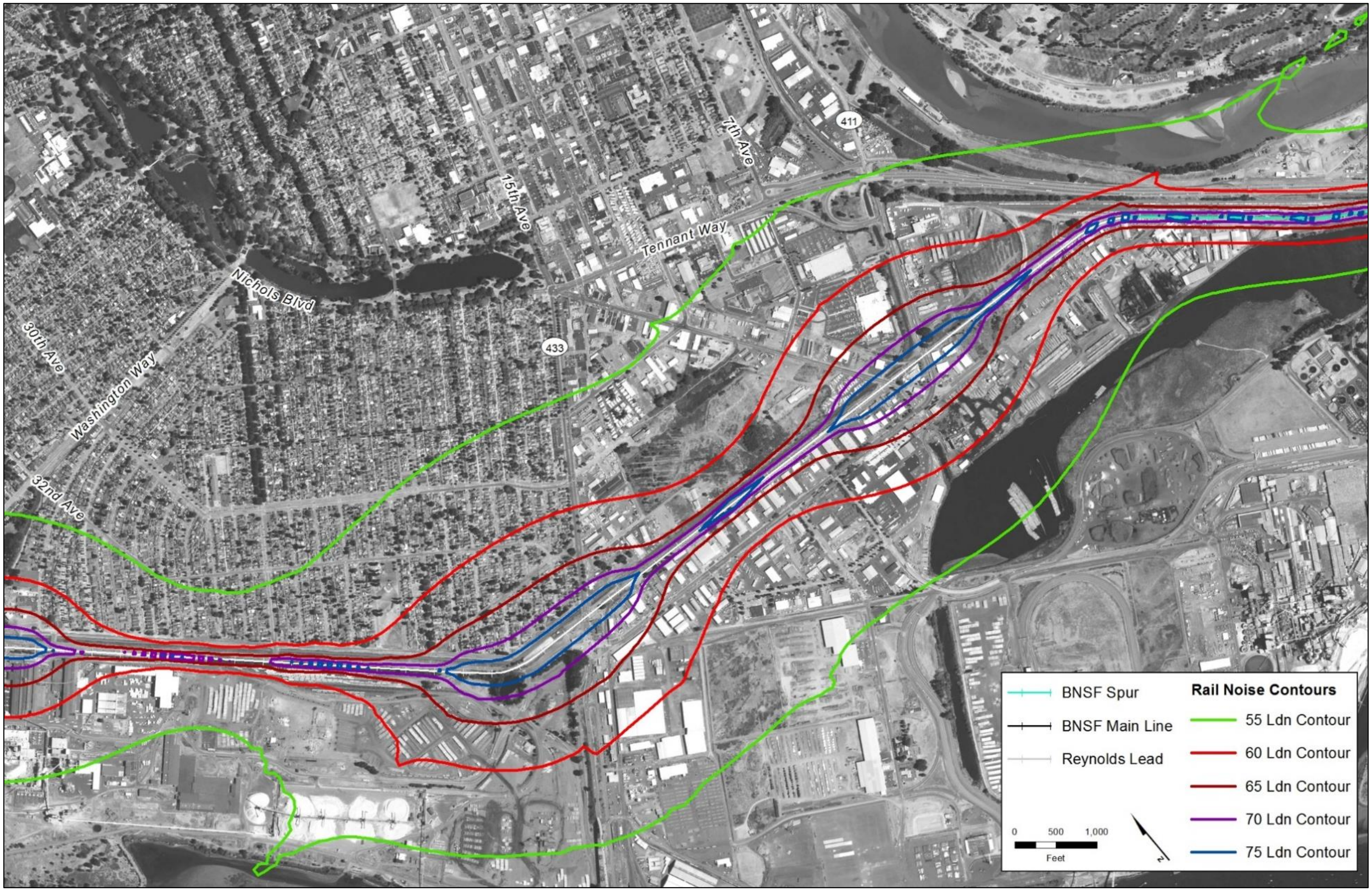


Figure 6.5-7d. Noise Contours with On-Site Alternative 2028 Rail Traffic, End of Reynolds Lead, Including Train Horns

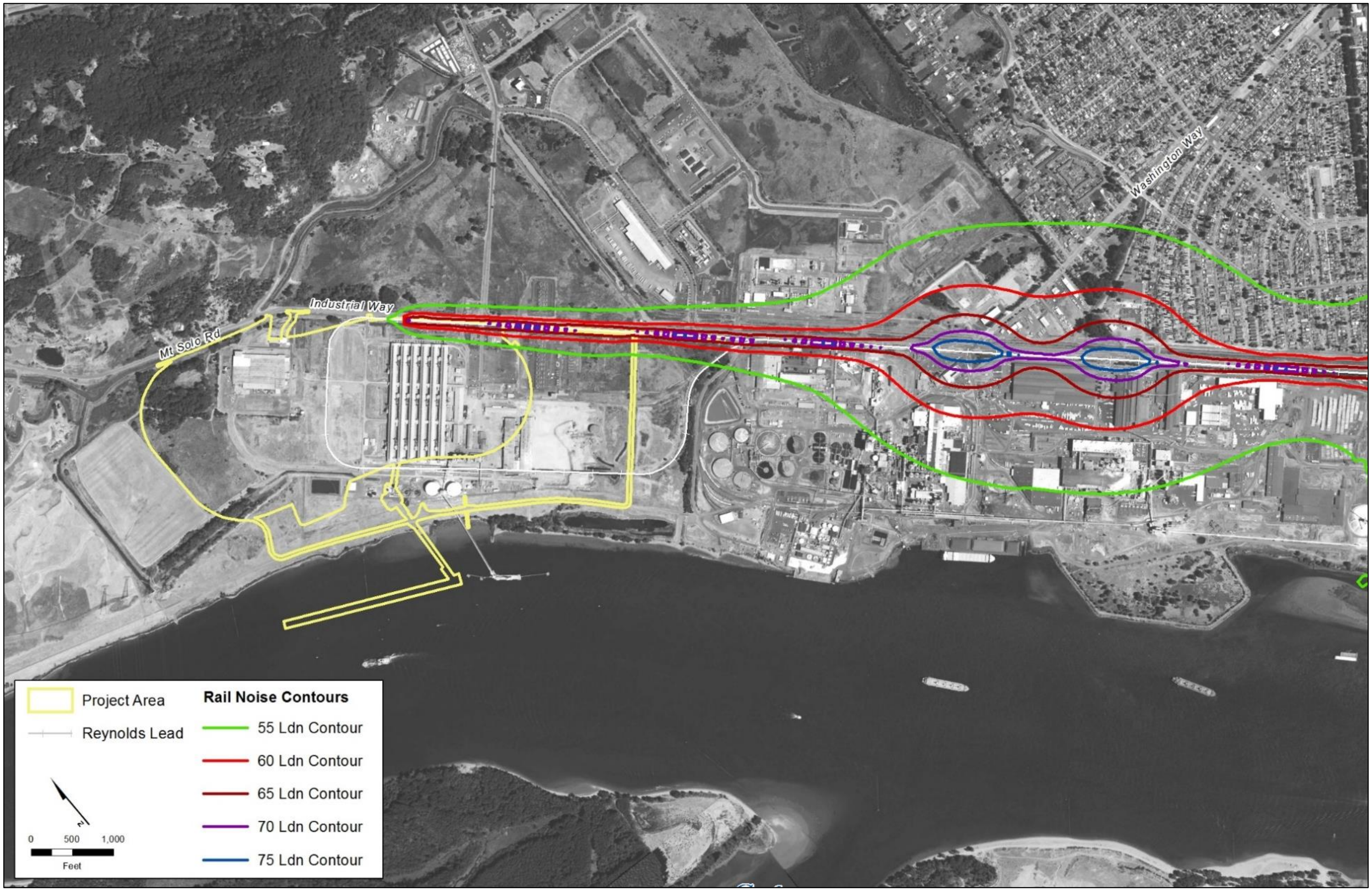


Table 6.5-4. Estimated Number of Noise-Sensitive Receptors Affected by Project-Related Trains

Reynolds Lead Crossing(s)	Estimated Number of Receptors Impacted	
	Moderate Noise Impact	**Severe Noise Impact**
3rd Avenue & California Way	34 mobile homes	10 mobile homes
Oregon Way & Industrial Way	2 mobile homes 133 single-family 18 multifamily[b]	34 single family 5 multifamily[d]
Private driveway at Weyerhaeuser (near Douglas Street & Industrial Way)	4 single family 2 multifamily[c]	0
Total Receptors	**193**	**49**

Notes:
[a] Per FTA/FRA guidance as described in Section 6.5.3, *Methods*.
[b] Estimated 52 individual residences affected.
[c] Estimated 4 individual residences affected.
[d] Estimated 16 individual residences affected.

As shown in the Table 6.5-4, an estimated 193 receptors representing approximately 229 residences would be exposed to a moderate noise impact, and an estimated 49 receptors representing approximately 60 residences would be exposed to a severe noise impact with project-related trains. These impacts would be the same with or without the track improvements to the Reynolds Lead because the train noise would be dominated by the locomotive horn sounding at grade crossings. Project-related trains without horn sounding would not result in noise impacts for train speeds at 10 or 20 miles per hour on the Reynolds Lead.

Vessel Operations Noise

The terminal would load 70 vessels per month or 840 vessels per year. This equates to 1,680 vessel transits in the Columbia River. Noise from terminal-related vessels would not cause a noise impact at noise-sensitive receptors. For vessels moored at the project area docks (Docks 2 and 3), the noise associated with stationary vessels is estimated to be 29 dBA at the closest noise-sensitive receptors on Mt. Solo Road, approximately 3,800 feet from the docks in the project area. This estimated project-related vessel noise would be comparable to or less than ambient noise levels at the closest noise-sensitive receptors.

Terminal-related vessel traffic is comparable to or less than existing noise levels, and is unlikely to cause noise impacts along the Columbia River. For vessels under way in the Columbia River, vessel traffic is expected to be 70 ships per month during full operation in 2028. This corresponds to an average of 4.7 vessel transits per day. The noise-sensitive receptors on Barlow Point Road are all more than 400 feet from the edge of the Columbia River. The anticipated typical minimum distance between these closest receptors and the vessels would be about 1,600 feet. The 32 L_{dn} experienced by these closest noise-sensitive receptors would be comparable or less than existing noise levels.

Figure 6.5-8. Noise-Sensitive Receptors Predicted to be Exposed to Moderate and Severe Noise Impacts

Table 6.5-5 summarizes the potential L_{dn} from project-related vessel traffic in 2028 at various perpendicular distances from the Columbia River navigational channel. Overall, the estimated noise exposure from project-related vessel traffic would be comparable to or less than ambient noise levels at noise-sensitive receptors and is unlikely to cause noise impacts along the Columbia River.

Table 6.5-5. Potential Noise Exposure Levels from Vessel Traffic at Various Perpendicular Distances from the Columbia River Navigational Channel

Distance (feet)	L_{dn}
400	44
600	40
800	38
1000	36
1200	34
1400	33
1600	32

Noise from foghorns is infrequent and is not expected to cause noise impacts at the noise-sensitive receptors. A foghorn recorded from Barlow Road sounded for approximately 4 seconds every 2 minutes and achieved a maximum noise level of 60 dBA at its point of closest approach to the measurement location (approximately 1,800 feet). These noise levels represent the highest foghorn sound levels to which noise-sensitive receptors on Barlow Point Road are exposed. In addition, with the exception of one noise-sensitive receptor, the levee that runs between the Columbia River and Barlow Point Road serves to some extent as a sound barrier.

6.5.5.2 Off-Site Alternative

This section describes the potential impacts in the study area as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location.

Construction—Direct Impacts

Construction-related activities associated with the export terminal at the Off-Site Alternative location could result in direct impacts as described below.

Noise

The maximum noise level at the closest noise-sensitive receptor (the residence at 104 Bradford Place) would be 83 A-weighted decibels (dBA), which would occur during construction to extend the Reynolds Lead. While not a regulatory noise standard for construction noise, to provide context, this noise level would exceed the FTA/FRA noise-level criterion of 80 dBA for construction noise. Noise levels would not exceed 80 dBA at any other times during construction.

Vibration

The maximum predicted vibration levels at the closest vibration-sensitive receptor (104 Bradford Place) would be 67 velocity decibels during construction to extend the Reynolds Lead. While not a regulatory standard for vibration during construction, to provide context, this vibration level would not exceed FTA/FRA criteria for vibration from construction at residences. Vibration from construction would be not be substantial enough to have an adverse impact at the nearest residence.

Construction—Indirect Impacts

Construction of the terminal at the Off-Site Alternative location would have the same indirect impacts as the On-Site Alternative. As described for the On-Site Alternative, the terminal at the Off-Site Alternative location would not result in indirect noise or vibration impacts related to construction road or rail traffic.

Operations—Direct Impacts

Operation of the terminal at the Off-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

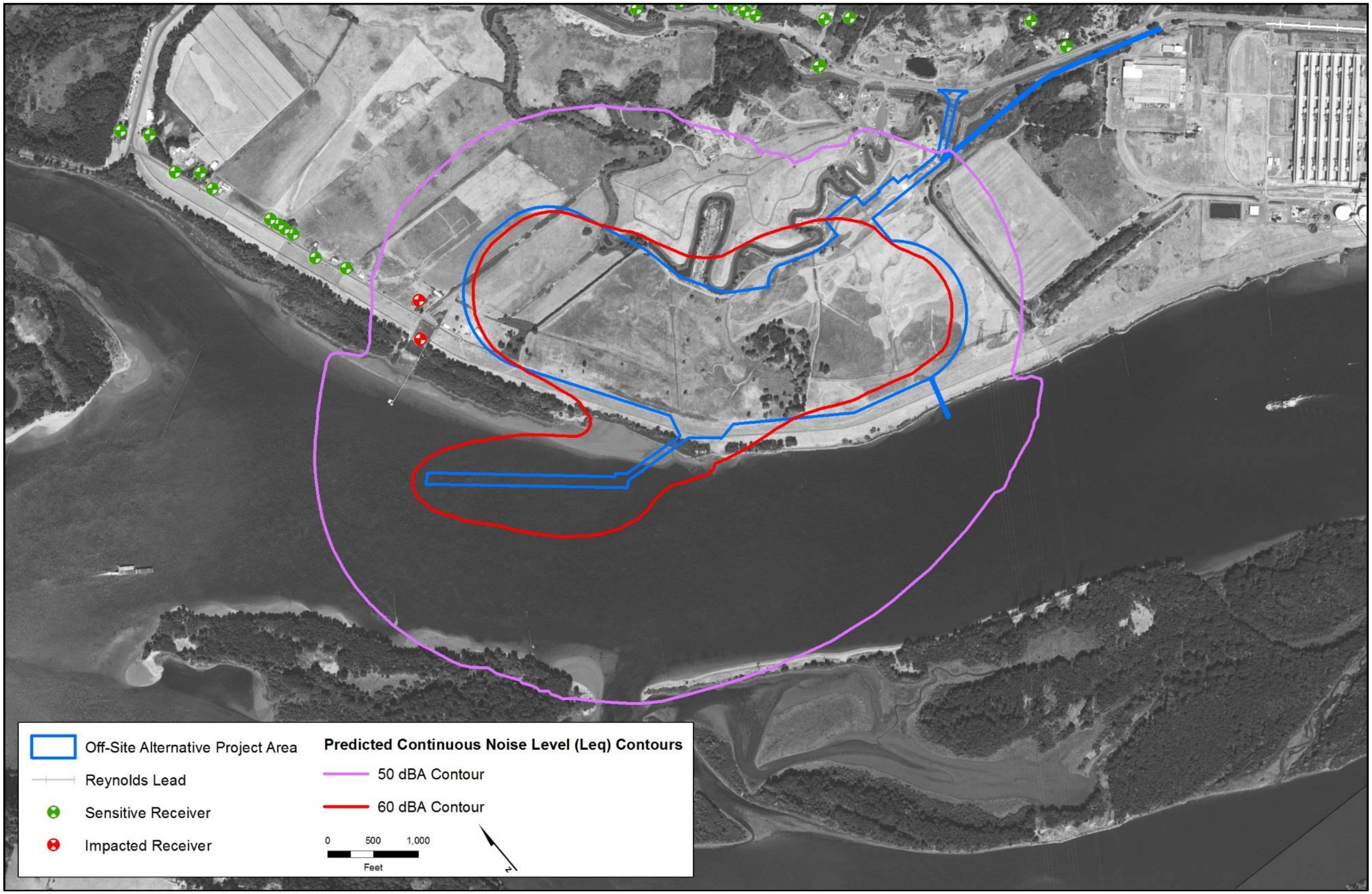
Noise

Figure 6.5-9 shows the predicted noise contours for operation of the terminal at the Off-Site Alternative location. Noise from export terminal operations is projected to exceed the Washington State noise standard at two residences (263 Barlow Point Road and 274 Barlow Point Road). These residences are within the 50-dBA contour, which is the applicable Washington State limit for nighttime noise levels in a residential area when the noise is from an industrial source. The predicted noise level at the residence is 53 dBA. Other residences are located outside the noise level limit contours or would be shielded by topography.

Vibration

As described in Section 6.5.3, *Methods*, no vibration impacts associated with operation of the terminal at the Off-Site Alternative location are anticipated. No substantial sources of ground vibration would occur at the project area during operations, and the closest vibration-sensitive receptor (a residence) is too far away to be affected by vibration from trains on the rail loop in the project area.

Figure 6.5-9. Predicted Continuous Noise Level (L_{eq}) Contours during Operations of the Off-Site Alternative



Operations—Indirect Impacts

Operation of the terminal at the Off-Site Alternative location would result in the following indirect impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Vehicle Traffic Noise

This impact would be the same as described for the On-Site Alternative.

Rail Traffic Noise

This impact would be the same as described for the On-Site Alternative.

Vessel Operations Noise

The terminal would load 70 vessels per month or 840 vessels per year. For vessels moored at the project area docks (Docks A and B), the noise associated with stationary vessels is estimated to be 37 dBA at the closest noise-sensitive receptors on Barlow Point Road, approximately 1,600 feet from the docks in the project area. This estimated project-related vessel noise would be comparable to or less than ambient noise levels at the closest noise-sensitive receptors.

The noise from project-related vessels underway and foghorns would be the same as described for the On-Site Alternative.

6.5.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to noise and vibration.

A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, approximately 2 trains per day would use the Reynolds Lead and BNSF Spur. The potential for changes in noise levels of 2 train trips per day on the Reynolds Lead and BNSF Spur were analyzed for 2028. Plots of the equal L_{dn} noise levels from rail traffic related to the No-Action Alternative in 2028 are available in the *NEPA Noise and Vibration Technical Report*. This assessment showed the net increases relative to the existing noise exposure from 2 additional train trips per day on the Reynolds Lead and BNSF Spur did not reach the thresholds of moderate or severe impact. Vehicle traffic volumes under the scenario evaluated for the No-Action Alternative would be less than the proposed export terminal and would not result in an adverse noise impact. The analysis also concluded there would be no vibration impacts because the closest receptors are too far away to experience meaningful vibration generated by trains on the Reynolds Lead and BNSF Spur.

6.5.6 Required Permits

No permits related to noise and vibration would be required for construction and operation of the proposed export terminal.